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ABSTRACT

A new natural fiber composite made of high density polyethylene (HDPE) and 40%wt short birch fibers (SBF) was developed to replace polyamide (better known under its industrial name "Nylon") in spur gear manufacturing. The effect of hygrothermal aging on quasi-static and fatigue bending behaviors of this new composite has been studied in this work. Once hygrothermal aging is completed, flexural quasi-static tests have been performed on aged specimens and results compared with those obtained from unaged specimens. It has been observed that hygrothermal aging has no significant effect on flexural mechanical properties of this composite. After characterization, bending fatigue tests have been conducted on aged specimens and results have been compared with those of unaged specimens. These fatigue tests show that hygrothermal aging decreases the high cycles fatigue strength (HCFS) of this composite. The cause of this fatigue durability decrease has been investigated using Fourier transform infrared spectroscopy (FT-IR), thermogravimetric analysis (TGA) and a scanning electron microscope (SEM). These tests show that the chemical composition and thermal behavior of this composite are not affected by hygrothermal aging. On the contrary, these tests show that damage mechanisms of this composite (HDPE/40%wt of SBF) are directly affected by this type of aging.

Keywords: hygrothermal aging, fatigue durability, residual strength, damage mechanisms, natural fiber composite